What is claimed is:

1. A method of reducing noise in a video image, comprises the steps of:

(a) decomposing the video image by a transform into multiple resolution levels representing different classes of image data;

(b) selecting threshold values based on the relationships between the noise standard deviations of different decomposition levels in the transform domain and the noise standard deviation of the original video image;

(c) applying a thresholding function to the transform coefficients of the classes of data in different resolution levels with different selected threshold values, to essentially eliminate image information corresponding to noise in the classes of data; and

(d) reassembling the classes of data at said multiple resolution levels into a reconstructed image with reduced noise.

2. The method of claim 1, wherein:

In step (a) decomposing the image further includes the steps of decomposing the video image by

wavelet transformation into multiple resolution levels representing different classes of image data;

In step (b) selecting the threshold values further includes the steps of selecting the threshold values based on the relationships between the noise standard deviations of different decomposition levels in the wavelet domain and the noise standard deviation of the original video image;

In step (c) applying the thresholding function further includes the steps of applying the thresholding function to the wavelet coefficients of the classes of data in different resolution levels with different selected threshold values, to essentially eliminate image information corresponding to noise in the classes of data; and

In step (d) reassembling the image further includes the steps of reassembling the classes of data at said multiple resolution levels into a reconstructed image with reduced noise using an inverse wavelet transformation.

3. The method of claim 2, wherein in step (b) the threshold values are selected based on the relationships between the noise standard deviations of different

decomposition levels in the wavelet domain and the noise standard deviation of the original image.

4. The method of claim 2, wherein in step (b) each threshold value for each resolution level is based on the noise standard deviation of the input image, and a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain.

5. The method of claim 2, wherein step (c) further includes the steps of applying a thresholding function $\delta_T(w) = \mathrm{sgn}(w)\max(|w| - T, 0)$ to different wavelet resolution levels with a different threshold value T, wherein each threshold value T_i for level i is represented as:

$$T_i = C_i * \sigma \text{ with } i = 1,2,...,K,$$

Wherein: k represents the number of resolution levels;

σ represents the noise standard deviation of the input image;

C_i's represent a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain;

$\mathrm{sgn}(w)$ provides the sign of a wavelet coefficient value w; and

$\max(a,b)$ provides the larger one of the two values a and b.

6. The method of claim 5, wherein the wavelet transform comprises a 9/7 wavelet.

7. The method of claim 6, wherein:

The steps of decomposing the video image using the 9/7 wavelet transform further includes the steps of using a 9-tap low pass filter with coefficients (0.026749, -0.016864, -0.078223, 0.266864, 0.602949, 0.266864, -0.078223, -0.016864, 0.026749), and using 7-tap high pass filter with coefficients (-0.045636, 0.028772, 0.295636, -0.557543, 0.295636, 0.028772, -0.045636), for decomposing the input image up to 4 levels;

The steps of applying the thresholding function further includes the steps of applying the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.50 * \sigma$, $T_2 = 0.28 * \sigma$, $T_3 = 0.13 * \sigma$, and $T_4 = 0.06 * \sigma$, such that σ is the noise standard deviation of the input image; and

The steps of reassembling the image further comprises the steps of performing an the inverse 9/7 wavelet transform to reconstruct the image.

8. The method of claim 5, wherein the wavelet transform comprises a 5/3 wavelet.

9. The method of claim 8, wherein:

The steps of decomposing the video image using the 5/3 wavelet transform further includes the steps of using a 5-tap low pass filter with coefficients (-0.125, 0.250, 0.750, 0.250, -0.125), and using 3-tap high pass filter with coefficients (0.250, -0.500, 0.250), for decomposing the input image up to 4 levels;

The steps of applying the thresholding function further includes the steps of applying the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.38 * \sigma$, $T_2 = 0.33 * \sigma$, $T_3 = 0.22 * \sigma$, and $T_4 = 0.13 * \sigma$, such that σ is the noise standard deviation of the input image; and

The steps of reassembling the image further comprises the steps of performing an the inverse 5/3 wavelet transform to reconstruct the image.

10. The method of claim 5, further comprising the steps of determining the C_i parameters for a discrete wavelet transform such that:

The noise standard deviations of different decomposition levels in the wavelet domain decrease as the decomposition levels increase, and

The noise standard deviations in the wavelet domain are linearly dependent on the noise standard deviation of the original image.

11. The method of claim 10, further comprising the steps of determining the C_i parameters based on the linear dependency between the noise standard deviations in the wavelet domain and the noise standard deviation of the original image, wherein the linear dependency provides a choice of the threshold values.

12. A method of reducing noise in a video image, comprises the steps of:

(a) decomposing the video image by discrete wavelet transformation into multiple resolution levels;

(b) selecting the threshold values based on the relationships between the noise standard deviations of

different decomposition levels in the wavelet domain and the noise standard deviation of the original video image;

(c) applying a thresholding function to the wavelet coefficients of the different resolution levels with different selected threshold values; and

(d) reassembling the image by inverse discrete wavelet transformation of the coefficients of the different resolution levels, wherein the reassembled image has reduced noise.

13. The method of claim 12, wherein in step (b) the threshold values are selected based on the relationships between the noise standard deviations of different decomposition levels in the wavelet domain and the noise standard deviation of the original image.

14. The method of claim 12, wherein in step (b) each threshold value for each resolution level is based on the noise standard deviation of the input image, and a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain.

15. The method of claim 12, wherein step (c) further includes the steps of applying a thresholding function

$\delta_T(w) = \mathrm{sgn}(w)\max(|w| - T, 0)$ to different wavelet resolution levels with a different threshold value T, wherein each threshold value T_i for level i is represented as:

$$T_i = C_i * \sigma \text{ with } i = 1,2,\ldots,K,$$

Wherein: k represents the number of resolution levels;

σ represents the noise standard deviation of the input image;

C_i's represent a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain;

$\mathrm{sgn}(w)$ provides the sign of a wavelet coefficient value w; and

$\max(a,b)$ provides the larger one of the two values a and b.

16. The method of claim 15, wherein the wavelet transform comprises a 9/7 discrete wavelet transform.

17. The method of claim 16, wherein:

The steps of decomposing the video image using the 9/7 wavelet transform further includes the steps of using a 9-tap low pass filter with coefficients (0.026749,

-0.016864, -0.078223, 0.266864, 0.602949, 0.266864, -0.078223, -0.016864, 0.026749), and using 7-tap high pass filter with coefficients (-0.045636, 0.028772, 0.295636, -0.557543, 0.295636, 0.028772, -0.045636), for decomposing the input image up to 4 levels;

The steps of applying the thresholding function further includes the steps of applying the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.50 * \sigma$, $T_2 = 0.28 * \sigma$, $T_3 = 0.13 * \sigma$, and $T_4 = 0.06 * \sigma$, such that σ is the noise standard deviation of the input image; and

The steps of reassembling the image further comprises the steps of performing an the inverse 9/7 discrete wavelet transform to reconstruct the image.

18. The method of claim 15, wherein the wavelet transform comprises a 5/3 discrete wavelet transform.

19. The method of claim 18, wherein:

The steps of decomposing the video image using the 5/3 wavelet transform further includes the steps of using a 5-tap low pass filter with coefficients (-0.125, 0.250, 0.750, 0.250, -0.125), and using 3-tap high pass

filter with coefficients (0.250, -0.500, 0.250), for decomposing the input image up to 4 levels;

The steps of applying the thresholding function further includes the steps of applying the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.38 * \sigma$, $T_2 = 0.33 * \sigma$, $T_3 = 0.22 * \sigma$, and $T_4 = 0.13 * \sigma$, such that σ is the noise standard deviation of the input image; and

The steps of reassembling the image further comprises the steps of performing an the inverse 5/3 discrete wavelet transform to reconstruct the image.

20. The method of claim 15, further comprising the steps of determining the C_i parameters for a discrete wavelet transform such that:

The noise standard deviations of different decomposition levels in the wavelet domain decrease as the decomposition levels increase, and

The noise standard deviations in the wavelet domain are linearly dependent on the noise standard deviation of the original image.

21. The method of claim 20, further comprising the steps of determining the C_i parameters based on the linear dependency between the noise standard deviations in the wavelet domain and the noise standard deviation of the original image, wherein the linear dependency provides a choice of the threshold values.

22. An image processing system for reducing noise in a video image, comprising:

(a) transform processor that decomposes the video image into multiple resolution levels representing different classes of image data;

(b) a thresholding processor the applies a thresholding function to the transform coefficients of the classes of data in different resolution levels with different selected threshold values, to essentially eliminate image information corresponding to noise in the classes of data,

Wherein the threshold values are based on the relationships between the noise standard deviations of different decomposition levels in the transform domain and the noise standard deviation of the original video image; and

(s) an inverse transform processor that reassembles the classes of data at said multiple resolution levels into a reconstructed image with reduced noise.

23. The system of claim 22, wherein:

The transform processor comprises a wavelet transform processor that decomposes the video image by wavelet transformation into multiple resolution levels representing different classes of image data;

The threshold values are based on the relationships between the noise standard deviations of different decomposition levels in the wavelet domain and the noise standard deviation of the original video image;

The thresholding processor applies the thresholding function to the wavelet coefficients of the classes of data in different resolution levels with different selected threshold values, to essentially eliminate image information corresponding to noise in the classes of data; and

The inverse transform processor reassembles the classes of data at said multiple resolution levels into a reconstructed image with reduced noise using an inverse wavelet transformation.

24. The system of claim 23, wherein the threshold values are based on the relationships between the noise standard deviations of different decomposition levels in the wavelet domain and the noise standard deviation of the original image.

25. The system of claim 23, wherein each threshold value for each resolution level is based on the noise standard deviation of the input image, and a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain.

26. The system of claim 23, wherein the threshold processor further applies the thresholding function $\delta_T(w) = \mathrm{sgn}(w)\max(|w| - T, 0)$ to different wavelet resolution levels with a different threshold value T, wherein each threshold value T_i for level i is represented as:

$$T_i = C_i * \sigma \text{ with } i = 1,2,\ldots,K,$$

Wherein: k represents the number of resolution levels;

σ represents the noise standard deviation of the input image;

C_i's represent a linear relationship between the noise distribution in the wavelet domain and the noise distribution in the spatial domain;

$\text{sgn}(w)$ provides the sign of a wavelet coefficient value w; and

$\max(a,b)$ provides the larger one of the two values a and b.

27. The system of claim 26, wherein the transform processor comprises a 9/7 wavelet transform processor.

28. The system of claim 27, wherein:

The transform processor comprises a 9-tap low pass filter with coefficients (0.026749, -0.016864, -0.078223, 0.266864, 0.602949, 0.266864, -0.078223, -0.016864, 0.026749), and a 7-tap high pass filter with coefficients (-0.045636, 0.028772, 0.295636, -0.557543, 0.295636, 0.028772, -0.045636), for decomposing the input image up to 4 levels;

The thresholding processor applies the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.50 * \sigma$, $T_2 = 0.28 * \sigma$, $T_3 = 0.13 * \sigma$, and $T_4 = 0.06 * \sigma$, such

that σ is the noise standard deviation of the input image; and

The inverse transform processor comprises an inverse 9/7 wavelet transform processor.

29. The system of claim 26, wherein the transform processor comprises a 5/3 wavelet transform processor.

30. The system of claim 29, wherein:

The transform processor comprises a 5-tap low pass filter with coefficients (-0.125, 0.250, 0.750, 0.250, -0.125), and a 3-tap high pass filter with coefficients (0.250, -0.500, 0.250), for decomposing the input image up to 4 levels;

The thresholding processor applies the threshold function to each level i, wherein $i = 1,2,3,4$, with threshold values $T_1 = 0.38 * \sigma$, $T_2 = 0.33 * \sigma$, $T_3 = 0.22 * \sigma$, and $T_4 = 0.13 * \sigma$, such that σ is the noise standard deviation of the input image; and

The inverse transform processor comprises an inverse 5/3 wavelet transform processor.

31. The system of claim 26, wherein the C_i parameters for a discrete wavelet transform are selected such that:

The noise standard deviations of different decomposition levels in the wavelet domain decrease as the decomposition levels increase, and

The noise standard deviations in the wavelet domain are linearly dependent on the noise standard deviation of the original image.

32. The system of claim 31, wherein the C_i parameters are based on the linear dependency between the noise standard deviations in the wavelet domain and the noise standard deviation of the original image, wherein the linear dependency provides a choice of the threshold values.